

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)	
)	
Inquiry Regarding Carrier Current Systems,)	ET Docket No. 03-104
Including Broadband over)	
Power Line Systems)	

REPLY COMMENTS OF HARRIS CORPORATION

Harris Corporation (“Harris”) respectfully submits comments in response to the Federal Communications Commission’s (“Commission”) Notice of Inquiry (“*NOP*”) in the above-captioned proceeding concerning the Commission’s rules and policies relating to Broadband over Power Line (“BPL”) systems.¹

I. INTRODUCTION AND SUMMARY

Harris is an international communications equipment company with five operating divisions that offer products and services in the microwave, broadcast, network support, secure tactical radio, and government communications systems markets. As the world’s leading broadcast transmission equipment supplier, Harris’s Broadcast Communication Division is the leader in digital solutions for television broadcasting and has been at the forefront of the transition to digital television, supplying the majority of the digital television (“DTV”) transmitters and encoders in the United States.

Harris recognizes the Commissions’ charter to continually encourage creativity and innovation in the nations’ telecommunications infrastructure. We have witnessed the benefits of this policy reflected in the overall high level of telecommunications services available today in the U.S.

Harris also has recognized that a key element of the Commission's process of evaluating and approving new telecommunications systems has been thorough review of the potential interference with existing infrastructure to insure that new systems do not damage or disable operating networks, and the crafting of operating and deployment rules to prevent such interference. One such example has been the case of CATV systems deployment, where the Commission has provided strict rules regarding radio frequency ("RF") leakage from distribution cables to prevent interference with, among other things, broadcast television and aeronautical services.² Setting strict levels of maximum leakage and insuring that such leakage is truly measurable and controllable has been an essential element of the successful co-existence of wireless and CATV based services.

It is with great concern that we view the Commission's consideration of licensing of BPL, both as an "access" technology and for "in-premises" signal distribution. Unlike other methods of public broadband access, it is our belief that the use of power lines as a transmission medium for RF signals will result in substantial RF leakage radiation that will cause significant interference to existing and future potential wireless services. Further, we believe that leakage radiation from these systems will prove to be essentially uncontrollable and that in the case of future interference issues, few potential remedies will be available that would support the long-term co-existence of existing wireline and wireless services with the proposed BPL technology.

Although the provision of broadband services using BPL systems promises to provide an alternate platform for broadband deployment, that promise is far from being a

¹ *In the Matter of Inquiry Regarding Carrier Current Systems, including Broadband over Power Line Systems*, ET Docket No. 03-104, rel. April 28, 2003 (hereinafter "*NOI*").

reality due to serious interference issues that cannot be easily mitigated given the nascent state of the BPL technology. As the *NOI* aptly stated, both Access and In-House high-speed BPL technologies spread signals over a broad range of frequencies that are used by other licensed services, including broadcast television and radio, amateur radio terrestrial and satellite and public safety and law enforcement.³ Moreover, many radio and television receivers have intermediate frequency stages operating in the range of 10.7 - 48 MHz where BPL systems are likely to cause harmful interference. These interference issues have not been adequately addressed by the BPL industry. Harris urges the Commission to refrain from proposing rule changes to Part 15 until the BPL industry provides conclusive studies and test data demonstrating that BPL operations will not cause harmful interference to authorized services.

Moreover, as the Commission is aware, the transition from analog to DTV is an important public interest objective. Given the complicated nature of the issues involved in the DTV transition, it is imperative that the Commission refrain from any actions that may encumber the transition. By authorizing BPL services to operate in the low VHF spectrum, on any basis, the Commission will be creating serious transition problems for television channels 2-5, and thwarting the rollout of DTV. Thus, Harris urges the Commission to: 1) require the BPL industry to demonstrate that its In-House and Access BPL operations will not cause harmful interference to existing authorized services and 2) recognize the potential harmful interference caused to home entertainment systems by BPL systems.

² See 47 CFR § 76.601-76.611.

³ *Id.* at 18.

II. THE BPL INDUSTRY MUST PROVE THAT NO HARMFUL INTERFERENCE WILL BE CAUSED TO AUTHORIZED SERVICES.

As the NOI noted:

Both Access and In-House high-speed BPL technologies spread signals over a broad range of frequencies that are used by other services . . . Each of these authorized services in the spectrum must be protected from harmful interference.⁴

The Commission recognizes that BPL services will radiate substantial amounts of radio frequency (“RF”) energy that will cause severe interference to authorized services. BPL technologies use existing AC power line infrastructure, which was not intended to be an RF transmission line. Unlike other wired means of delivering Broadband Access to subscribers (ADSL, ISDN and Digital Cable), BPL will be provided via a network of completely unshielded conductors primarily designed for the transmission of 60 Hz AC power – a frequency range that is several orders of magnitude lower than the RF spectrum used to convey digital data signals. The nations’ power line infrastructure has completely uncontrolled, variable and, in many cases, totally unknown RF transmission characteristics. Uncontrolled RF interference generation is already seen from AC transmission systems, as in the case of wideband noise generated from broken or dirty power insulators. This form of interference alone can often propagate along transmission lines for miles, causing interference to communications and broadcast services well into the VHF frequency range.

Effective reuse of the RF spectrum for different services has at its basis the fundamental ability to shield systems from one-another, along with supporting the ability to deploy wireless communications systems in a controlled interference environment.

⁴ *Id.*

ADSL and ISDN digital services utilize self-shielding twisted pair copper conductors with controlled transmission characteristics to minimize radiation. CATV services are delivered via shielded coaxial cables that minimize radiation. The cable operators have gone to great lengths to minimize HF and VHF radiation from their installed plant and are subject to Commission regulation in this regard.⁵

Power line systems provide no such means of isolation. Power lines are essentially equivalent to antennas at the frequencies of interest - meaning that they are more efficient at radiating energy away from the power lines as RF energy than at propagating the signals along them. As such, the power line grid might be better modeled as a wide-area distributed antenna, rather than a set of individual “pipes” leading to customer homes. Existing wireless services operating in these bands can and will see a significant new source of potentially debilitating interference if this system is deployed.

The MF, HF and VHF bands of operation have uniquely valuable characteristics to radio operators in that, for relatively low power, long propagation distances can be obtained, line-of sight conditions are not required, and RF signals easily penetrate into the majority of man-made structures. These bands have long been considered the “prime real-estate” of the RF spectrum for that reason. Almost from its inception, the Commission has endeavored to insure that users of these bands operate in a controlled manner by providing operating parameters that ensure the long-term reliability of services utilizing these bands.

In addition, the AC power line is an electrically noisy environment unlike the benign digital-over-cable and DSL environments. As a result, the digital RF power level

⁵ 47 CFR § 76.601-76.611.

required by BPL technologies is much higher than that required by the other wired digital services, which further compounds the problem of BPL radiation into other services.

Harris is concerned that, as BPL systems are essentially distributed antenna systems, that the effects on the existing services will be profound and debilitating, and further will prove to be an inefficient method of utilizing the country's RF spectrum for delivering advanced services due to the unplanned effects of not only interference from and to other existing services, but from self-interference generated by the distributed nature of the power line network itself.

The high amount of interference from BPL into over-the-air services is well documented by tests in Europe, Japan and within the United States.⁶ In addition, the American Radio Relay League ("ARRL"), which represents the amateur radio services in the United States, conducted a well-documented interference study on the impact of BPL on the amateur radio services over the entire High Frequency and Low VHF spectrum.⁷ The results show an extremely high level of interference to all of the HF amateur radio services with the noise floor produced by BPL often being more than 50dB above the existing noise floor. Clearly, the evidence in the docket proves that there are serious interference issues that must be addressed.

As the Commission's rules state:

Operation of an intentional, unintentional, or incidental radiator is subject to the conditions that *no harmful interference is caused* and that interference must be accepted that may be caused by the operation of an authorized radio station, . . . (emphasis added).⁸

⁶ See Joint Comments of the Association for Maximum Service Television, Inc. and The National Association of Broadcasters, ET Docket No. 03-104, filed July 7, 2003 (hereinafter "MSTV/NAB Comments").

⁷ See Comments of the American Radio Relay League, ET Docket No. 03-104, filed July 7, 2003.

⁸ 47 C.F.R. §15.5.

The BPL industry has not been able to prove conclusively that *no harmful interference is caused* as the Commission's rules mandate. Instead, the evidence in the docket clearly demonstrates quite the opposite: the pervasive nature of the interference issues if the BPL industry is permitted to rollout its services.⁹ One of the only studies submitted, the study by Ameren Energy Communications, Inc. ("AEC"), provided a cursory study as to the interference issues. The AEC submission was a periodic report required as a condition of their experimental authorization. Moreover, the study evaluated operations between 2-20 MHz and hence provides no useful information about wider bandwidth BPL systems' impact on the TV broadcast bands. In order to comply with Part 15 of the Commission's rules, the BPL industry must conduct appropriate studies to demonstrate that harmful interference will not be caused or can be adequately mitigated. Harris urges the Commission to require the BPL industry to conduct comprehensive studies to conclusively address the interference issues. Without such studies, the Commission cannot proceed with proposing rules on technologies that will harmfully interfere with existing services.

III. BPL SYSTEMS CREATE HARMFUL INTERFERENCE TO BROADCAST OPERATIONS.

There are eleven DTV stations and hundreds of analog TV stations currently operating on channels 2 through 5. Channel 2 operates on 54-60 MHz, channel 3 operates on 60-66 MHz, channel 4 operates on 66-72 MHz and channel 5 operates on 76-82 MHz. These lower VHF bands are already heavily polluted with man-made impulse type background interference. Existing BPL studies reveal that the multi-carrier

⁹ *Supra* note 4 & 5. We also note that the Commission has received hundreds of comments from amateur radio operators highlighting the serious interference issues posed to their services by the BPL technologies.

modulation techniques employed by BPL systems have a spectral profile that resembles impulse noise.¹⁰ Studies on file with the Commission have shown that both DTV and analog reception is severely impaired by impulse noise in the low VHF band.¹¹ The studies revealed that the interleaver in DTV receivers reacts badly to impulse noise resulting in the inability of the TV set to produce a picture.¹²

Such an increase could adversely affect both analog and digital receivers. The disruption of the viewing experience, however, would be more significant in the DTV context, where interference would result in a loss of picture (rather than a snowy picture as in the analog environment). As the MSTV/NAB Comments aptly noted,¹³ Congress has expressed its disapproval of regulatory changes that would permit such service degradation.¹⁴ Anticipating efforts to clear channels 52-69 for new service (by permitting broadcasters occupying those channels to use in-core digital allotments for analog transmission), Congress forbade waivers of spacing or interference rules that would result in “*any* degradation in or loss of service, or an increased level of interference, to *any* television household except as the Commission’s rules would otherwise expressly permit.”¹⁵ If the Commission approves BPL operations in the lower VHF band, it will violate Congressional policy requiring the Commission to maintain an interference-free DTV service during the transition.

Moreover, permitting BPL to operate in the low VHF band is likely to severely exacerbate an already existing interference problem and could upset the Commission’s

¹⁰ MSTV/NAB Comments at 6.

¹¹ See VSB/COFDM project, VSB/COFDM Comparison Report, Dec. 2000; Advisory Committee on Advanced Television, Terrestrial Broadcast Field Tests, Oct. 1995.

¹² *Id.*

¹³ MSTV/NAB Comments at 6.

¹⁴ See Auction Reform Act of 2002, Pub. Law No. 107-195, 116 Stat. 716.

¹⁵ *Id.* at § 6(a) (emphasis added).

own policy of allowing broadcasters to choose to move their DTV station to their current NTSC channel. This issue could delay significantly the rollout of DTV.

IV. BPL SYSTEMS MAY CAUSE HARMFUL INTERFERENCE TO HOME ENTERTAINMENT SYSTEMS

BPL systems may cause harmful interference to home entertainment systems, in two different ways. First, harmful interference may be caused through direct interference to the primary broadcast frequency. These interfering signals would enter the receiver's antenna terminal. A second way that interference can enter the receiver is by direct radiation from the power line into the receiver's intermediate frequency ("IF") stages that operate in the frequency range from 10.7 to 48 MHz. This type of IF interference would impact the reception of all television and FM broadcast frequencies.

Current radio and television receivers are designed based on the assumption that RF energy will not leak into the receivers. It is well documented that due to the low propagation loss at these frequencies, such radiated energy can cause interference to other services at considerable distances.¹⁶ If BPL systems are permitted to operate, there is little to ensure that signal leakage and the harmonics generated from such operations will not interfere with home entertainment systems operating in the IF band. In addition, many home entertainment devices including computers are powered by switching power supplies. These power supplies will generate harmonics of the BPL energy on the AC wiring due to their non-linear characteristics. These harmonics will cause interference to receivers operating at frequencies much higher than the fundamental BPL frequencies.

V. CONCLUSION

Harris respects the Commission's interest in supporting the deployment of broadband services by utilizing BPL technologies. However, that interest must be balanced against the reality that BPL will cause harmful interference to existing services, including broadcast services and home entertainment systems, in particular. The Commission must require the nascent BPL industry to conduct comprehensive interference studies to identify the interference problems and acknowledge the serious interference issues posed to authorized services in general and broadcast services in particular.

Respectfully submitted,

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¹⁶ *Supra* note 1 at para. 5.